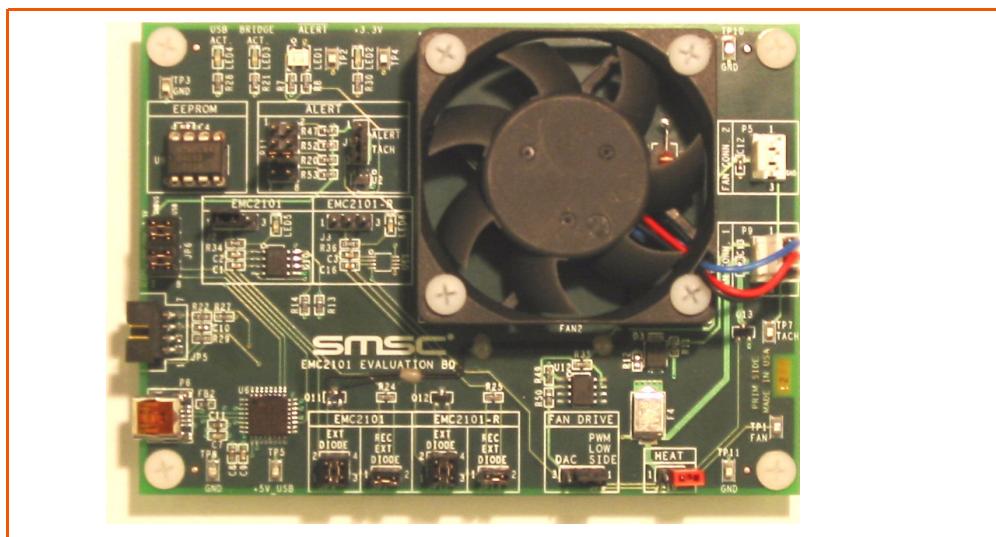




EVB-EMC2101 User Manual



The information contained herein is proprietary to SMSC, and shall be used solely in accordance with the agreement pursuant to which it is provided. Although the information is believed to be accurate, no responsibility is assumed for inaccuracies. SMSC reserves the right to make changes to this document and to specifications and product descriptions at any time without notice. Neither the provision of this information nor the sale of the described semiconductor devices conveys any licenses under any patent rights or other intellectual property rights of SMSC or others unless specifically specified otherwise. The product may contain design defects or errors known as anomalies, including but not necessarily limited to any which may be identified in this document, which may cause the product to deviate from published specifications. SMSC products are not designed, intended, authorized or warranted for use in any life support or other application where product failure could cause or contribute to personal injury or severe property damage. Any and all such uses without prior written approval of an officer of SMSC will be fully at the risk of the customer. SMSC is a registered trademark of Standard Microsystems Corporation ("SMSC").

SMSC DISCLAIMS AND EXCLUDES ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION ANY AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND AGAINST INFRINGEMENT AND THE LIKE, AND ANY AND ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR USAGE OF TRADE. IN NO EVENT SHALL SMSC BE LIABLE FOR ANY DIRECT, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES; OR FOR LOST DATA, PROFITS, SAVINGS OR REVENUES OF ANY KIND; REGARDLESS OF THE FORM OF ACTION, WHETHER BASED ON CONTRACT; TORT; NEGLIGENCE OF SMSC OR OTHERS; STRICT LIABILITY; BREACH OF WARRANTY; OR OTHERWISE; WHETHER OR NOT ANY REMEDY OF BUYER IS HELD TO HAVE FAILED OF ITS ESSENTIAL PURPOSE, AND WHETHER OR NOT SMSC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

1 Overview

The EMC2101 is an environmental monitoring device with a selectable PWM or DAC fan driver output, one external temperature monitoring channel and one internal temperature monitor. It contains advanced circuitry to remove errors induced by series resistance and CPU thermal diode process differences to provide accurate temperature measurements and accurate fan control.

The FAN output can be configured as a PWM (default) or DAC output. The PWM fan driver uses an eight entry look up table to create a programmable temperature response. The DAC output provides a linear drive for the system fan circuit using this same look up table.

Finally, the EMC2101-R has two configuration modes and two default fan settings based on the value of the pull-up-resistor on the ALERT pin. In the Manual Configuration Mode, the device acts as an SMBus client slave and waits to be configured by the system SMBus master. In the Automatic Configuration mode, the device automatically queries the SMBus for an EEPROM device and uploads configuration information from the EEPROM into its internal registers.

All of the modes and functions of the EMC2101 can be tested and observed with the EVB-EMC2101. The EVB-EMC2101 is a USB-based platform for evaluating both EMC2101 packages (8-MSOP and 8-SOIC).

1.1 Related Documents

The CD included with the evaluation board contains the following documents:

- Evaluation Board Checklist
- Bill Of Materials
- Schematic
- Jumper Settings and Connector List
- Datasheet
- Chip Manager Application
- Register Definition File (EMC2101.xml)

2 Getting Started

2.1 System Requirements

To use the EVB you will need:

- A PC running Windows 2000 or XP
- Display resolution 800x600 (or larger to view several windows simultaneously)
- An available USB port

2.2 Feature Summary

- Chip Manager (SMSC application) allows viewing and changing register values
- Graphing of any register
- Headers for connecting a remote diode or CPU/GPU thermal diode
- Resistance Error Correction verification
- Autonomous register loading via included EEPROM (EMC2101-R only)
- USB communication to evaluation board
- An external SMBus master may also be used via jumper settings

2.3 Installing the EVB

1. Install the Chip Manager (ChipMan) application and device driver on a PC by running Setup.exe from the ChipMan distribution CD. A revision history and install/uninstall notes may be found in the readme.txt file on the disk.
2. Connect the supplied USB cable to an available USB port on the PC. Plug the “mini-B” end of the USB cable into EVB connector P6. The +3.3V and Bridge ACT LEDs should illuminate. After the EVB is connected to the PC the “Find New Hardware” wizard will pop up for USB driver installation. Follow the instructions in the readme.txt file to complete the installation process.
3. Start the EVB Software by selecting the Chip Manager application from the SMSC folder from the Programs Windows Start menu. The EVB will initialize and the Chip Manager Quick Help screen will appear as in [Figure 2.1](#). The USBAct LED should be blinking when the Chip Manager is running. For more help with ChipMan, select Help -> Contents for an html based help document as shown in [Figure 2.2](#).

Note: The SMSC ChipMan application allows viewing and changing register values for a variety of EVBs including the EMC1001, EMC1002, EMC1023, EMC1033 and EMC2101. The ChipMan software only needs to be installed once to support all of these EVBs. The list of supported EVBs may be found in the pulldown menu under Options -> Select Device.

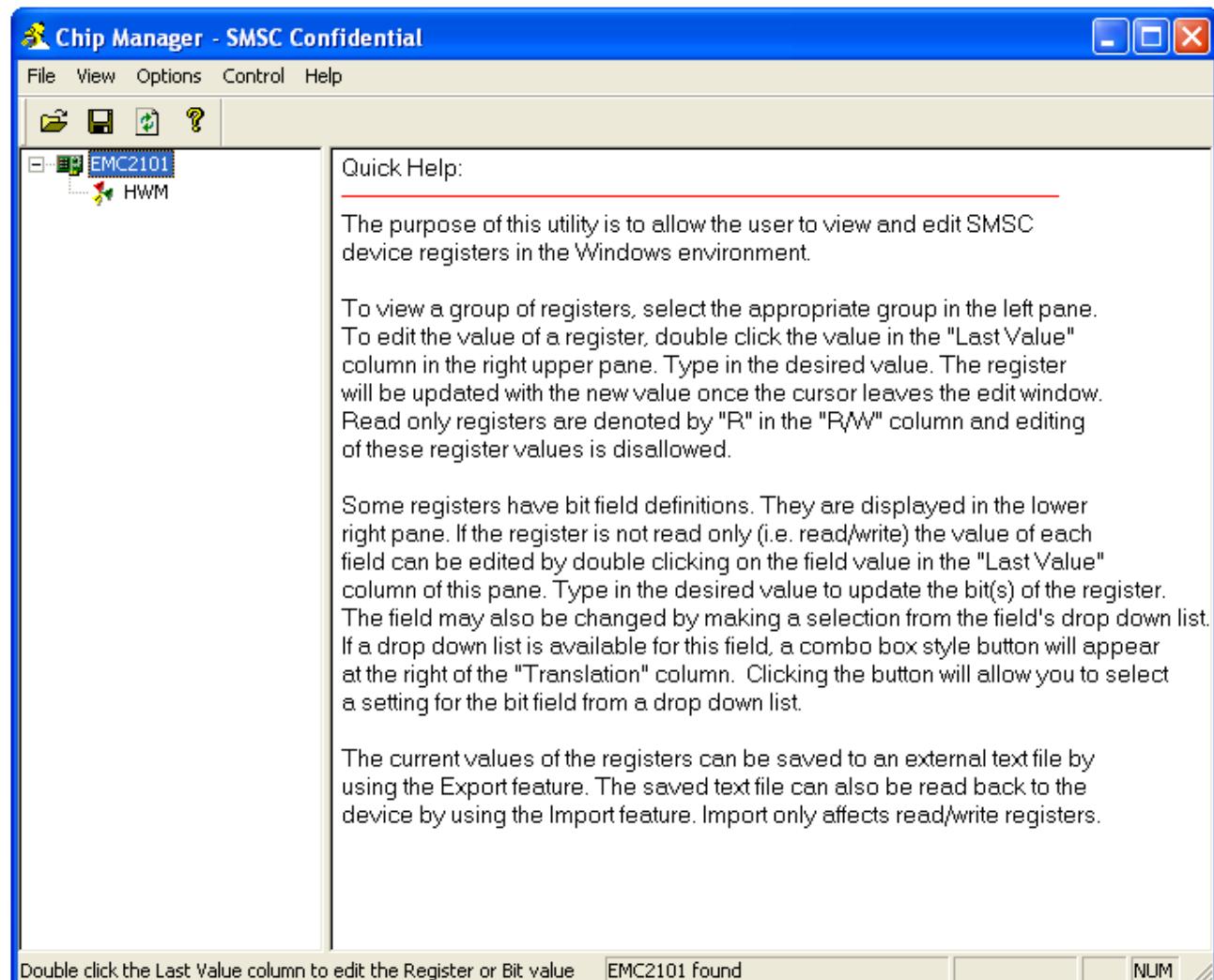


Figure 2.1 Chip Manager Quick Help Startup Screen

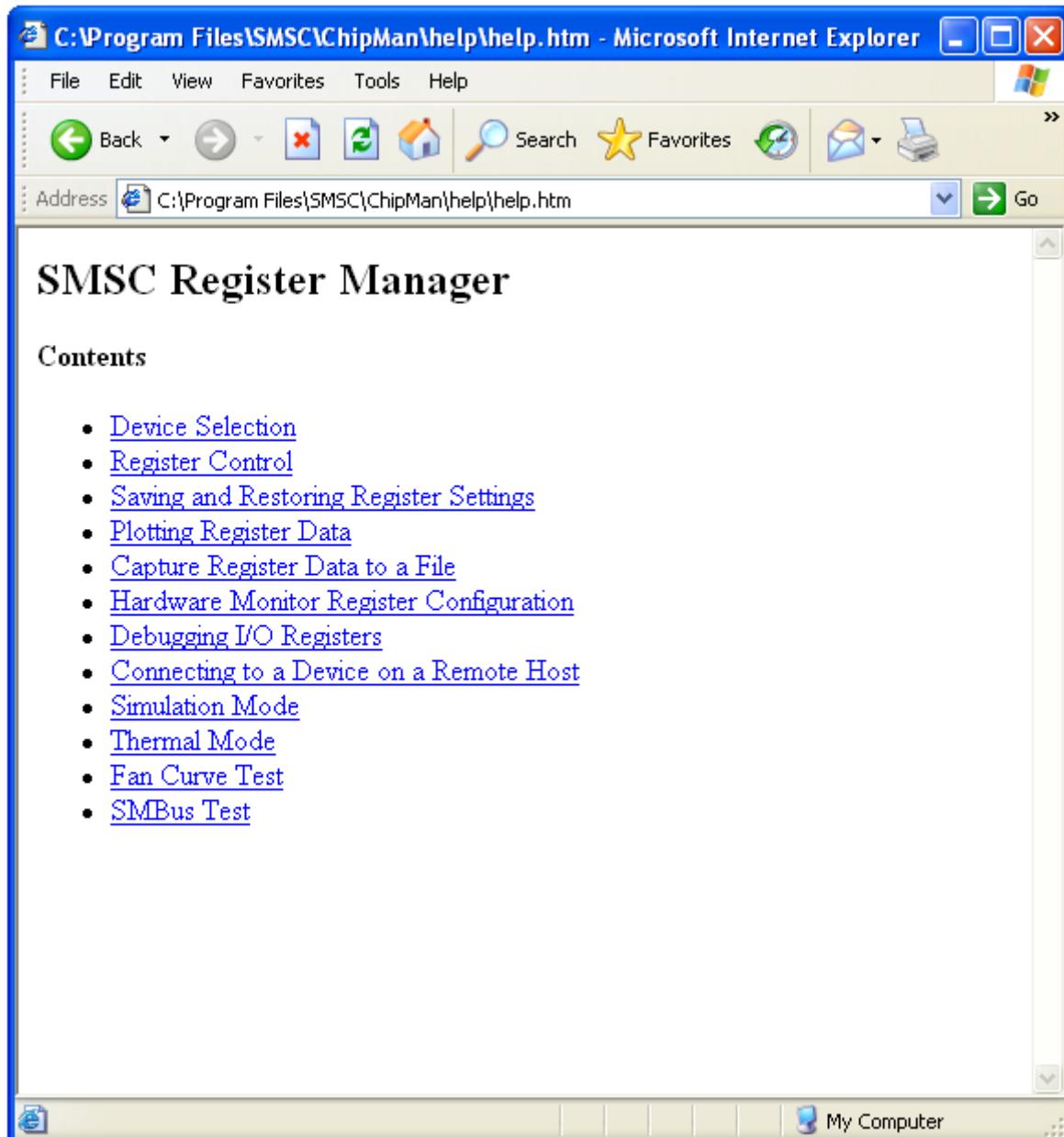


Figure 2.2 Chip Manager Help Screen

2.4 Board Layout

The EVB was designed for ease of use and user experimentation with easily accessible jumpers and access to the SMBus data lines. [Figure 2.3](#) below shows the silk-screen for the EMC2101 EVB.

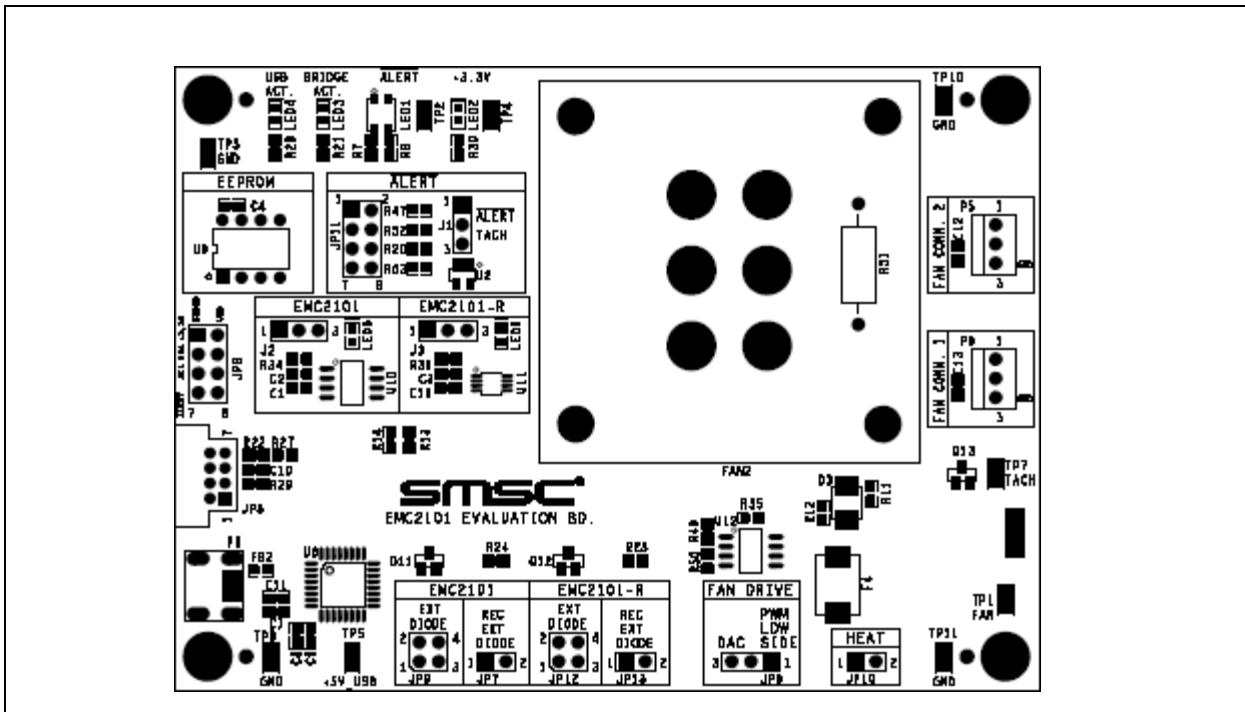


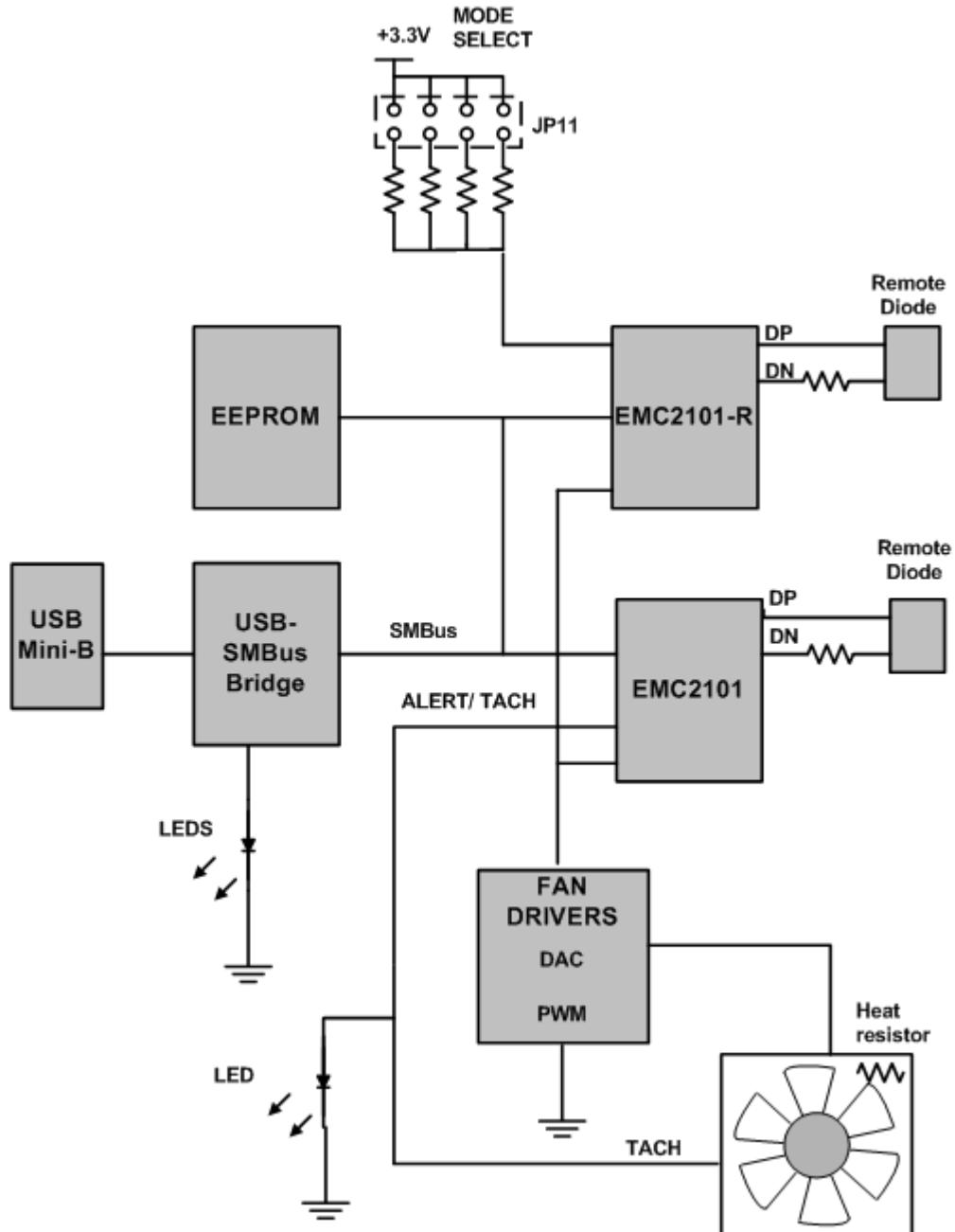
Figure 2.3 EMC2101 Board Outline and Silk-screen

3 Hardware Description

3.1 Introduction

The EMC2101 EVB provides the means to demonstrate EMC2101 features and to view and modify registers. A +12V fan and power supply are provided to demonstrate the fan control functionality. LEDs indicate status information and test points are included to monitor system voltages with a user provided voltmeter or oscilloscope. Figure 3.1 shows an overview of the EMC2101 EVB.

Figure 3.1 EVB Block Diagram



3.2 EMC2101

The EMC2101 is an SMBus temperature sensor with 1 internal and 1 external sensor in an 8 pin MSOP and 8 pin SOIC package. Communications with the EMC2101 sensor is via the SMBus.

3.3 USB to SMBus Bridge

The USB to SMBus bridge is based on an 8051 micro controller with integrated USB and SMBus interfaces as well as internal flash and RAM. During EVB manufacture, firmware is loaded into the bridge that provides the interface between the USB and the SMBus. Power is sourced to the micro controller from the USB interface for device power and communication.

3.3.1 Direct SMBus Connect Option

It is also possible to connect an external SMBus master to the EMC2101 EVB. A few jumper settings are all that is required to drive the EMC2101:

- Simply remove the jumpers on JP6 and connect the SMBus master to the SCL, SDA and ALERT pins, as well as an external supply for +3.3V.
- The +3.3V can be supplied by the SMBus bridge by leaving the +3.3V jumper in place and retaining the USB connection.

3.4 Connecting to Remote Diodes

This EVB is populated with jumpers to connect to an external diode or CPU/GPU. If connecting to a CPU's thermal diode, it is necessary to provide a common ground. Also, it is usually necessary to bias the appropriate CPU Vcc plane above this common ground to avoid forward-biasing the ESD diodes with the temperature sensor signals. Test point TP3, 8, 10, or 11 provides a ground connection. Consult the CPU manufacturer's datasheet for guidance on interfacing to the thermal diode. Refer to the schematic EVB-EMC2101 SCH-7069-REVB1.pdf for details on the EVB header connections.

3.5 Resistance Error Correction (REC)

The remote diode DN signal path has a 100 ohm series resistor to demonstrate the EMC2101's REC feature. The resistor may be effectively removed from the circuit by installing a jumper on JP7 or JP13 (-R diode). See [Table 3.4](#) for details on the REC jumper settings.

3.6 Power Source

This EVB requires only a USB cable. The USB-SMBus bridge regulates the +5V USB power to +3.3V used by the EMC2101 and other EVB circuitry such as the fan and resistive heater.

3.7 Test Points

Test points are provided for:

- Ground
- +3.3V power
- +5V_USB power
- FAN pin output
- ALERT output
- TACH for 3 wire fan (included)

3.8 LED Indicators

LEDs indicate the status of the following signals ([Table 3.1](#)).

Table 3.1 LED Status Indicators

LED	SIGNAL	OFF	GREEN	RED
LED1	$\overline{\text{ALERT}}$	+3.3V power OFF	No $\overline{\text{ALERT}}$	$\overline{\text{ALERT}}$
LED2	+3.3V	+3.3V power OFF	+3.3V power ON	NA
LED3	Bridge Activity	NO Activity on USB/SMBus Bridge	Activity on USB/SMBus Bridge	NA
LED4	USB Activity	NO Activity on USB port	Activity on USB port	NA
LED5	EMC2101 Power	U10 power OFF	U10 power ON	NA
LED6	EMC2101-R Power	U11 power OFF	U11 power ON	NA

3.9 Jumper Settings

This EVB has many jumper configurations to evaluate all of the features of the EMC2101.

3.9.1 Device Power

To enable one of the 2 devices on the EVB, use jumpers J2 and J3. When a device is selected, the appropriate LED will light as shown in [Table 3.1](#). [Table 3.2](#) below summarizes the options. Note: only one device may be active at a time as both devices have the same SMBus address.

Table 3.2 Device Power

JUMPER	NAME	POSITION 1-2	POSITION 2-3
J2	EMC2101 POWER	U10 power ON	U10 power OFF
J3	EMC2101-R POWER	U11 power ON	U11 power OFF

3.9.2 Fan Control

To adjust the fan control circuit one 3-way jumper is used. The two settings are DAC mode and PWM mode. The default setting is PWM which requires the fan to be connected to FAN CONN. 1 and the JP8 shorted from pin 1-2.

If the linear DAC mode is desired, several things need configured. First, JP8 must be shorted from pin 2-3 and the fan must be connected to FAN CONN. 2. Then, the device must be configured for linear operation via the ChipMan software. Consult the datasheet for these settings. [Table 3.3](#).

Table 3.3 Fan Driver Configuration

FAN DRIVER CONFIGURATION	JP8	FAN CONNECTOR
PWM	Position 1-2	P9
DAC	Position 2-3	P5

3.9.3 Remote Diode

The remote diode on board the EMC2101 EVB has a heater and an optional in-line series resistance adjustment. Checking the REC feature of the EMC2101 is accomplished by removing the jumper on JP7. This adds 100 ohms of series resistance to the DN line of the diode connection. To return to 0 ohm series resistance, replace the jumper on JP7.

To heat the diode, place a jumper on JP10. To return to ambient conditions, remove JP10. These remote diode options are summarized in [Table 3.4](#) below.

Table 3.4 Remote Diode Settings

JUMPER	NAME	OPEN	SHORT
JP7	REC	Q11 - 100 ohms in DN line (diode remote -)	Q11 - 0 ohms in DN line (diode remote -)
JP13	REC	Q12 - 100 ohms in DN line (diode remote -)	Q12 - 0 ohms in DN line (diode remote -)
JP10	HEATER	Ambient temp on remote diode (Q12)	1.0W resistive heater on remote diode (Q12)

This EVB also allows for an off-board diode to be tested (see [Table 3.5](#)). This is done by removing both jumpers on JP8. Then connect Pin 1 to the 'remote+' terminal of the remote diode and Pin 3 to the 'remote-' terminal of the remote diode. Make sure a common ground exists between the remote diode (GPU, etc.) and the EMC2101 EVB. Also ensure that the remote diode is properly biased according to the diode manufacturer.

Table 3.5 Remote Diode Configurations

CONFIGURATION	JUMPER	PIN 1	PIN 2	PIN 3	PIN 4
On-board diode (Q11)	JP9	short / DP		short / DN	
Off-board diode (CPU, GPU, etc.)	JP9	remote + / DP	open	remote - / DN	open
On-board diode (Q12)	JP12	short / DP		short / DN	
Off-board diode (CPU, GPU, etc.)	JP12	remote + / DP	open	remote - / DN	open

A unique feature of the EMC2101-R device is the ability to start in one of several different configurations based on the pull up resistor on the ALERT output. The EVB allows the user to quickly evaluate each of the 4 configurations by adjusting JP11 as shown in [Table 3.6](#). When using the auto load via EEPROM, ensure that the Autorefresh Registers is not selected until the loading is complete (less than 1 sec).

NOTE: Only **one** jumper is to be installed on JP11 and a minimum of **one** jumper must be installed for the device to operate.

Table 3.6 ALERT Pull-up Resistors - SMBus/FAN MODE

JUMPER	NAME	OPEN	SHORT
JP11	33k	NA	Auto load via EEPROM - Initial FAN 0% Duty Cycle
	18k	NA	Auto load via EEPROM - Initial FAN 100% Duty Cycle
	10k	NA	Host load via SMBus - initial FAN 0% Duty Cycle
	5.6k	NA	Host load via SMBus - initial FAN 100% Duty Cycle

3.10 Other Sensor Features

Other features such as Ideality Factor Configuration, Conversion Rate, Digital Filtering, Look-up Table Functionality, and Standby Mode can be controlled with EMC2101 registers. See the datasheet register description for details.

4 Software Description

4.1 Chip Manager Overview

The Chip Manager application (ChipMan) initially displays the main Help screen, where detailed description of the application's features may be found. The Help screens can be displayed at any time by selecting Help from the menu bar. ChipMan enables the user to display temperature readings, set temperature limits and read/write configuration register values.

4.2 Temperature/Register History Graph

To open a Temperature or Register History Graph window, select the register or registers to plot in the ChipMan application, then select Options -> Plot Register Data from the menu bar. Once the graph appears, select Control -> Start to begin plotting data. The history plot continuously updates the register data reported by the EMC2101. [Figure 4.1](#) below is a typical Temperature History with the external diode starting at room temp and then being heated using the HEATER jumper (JP2).

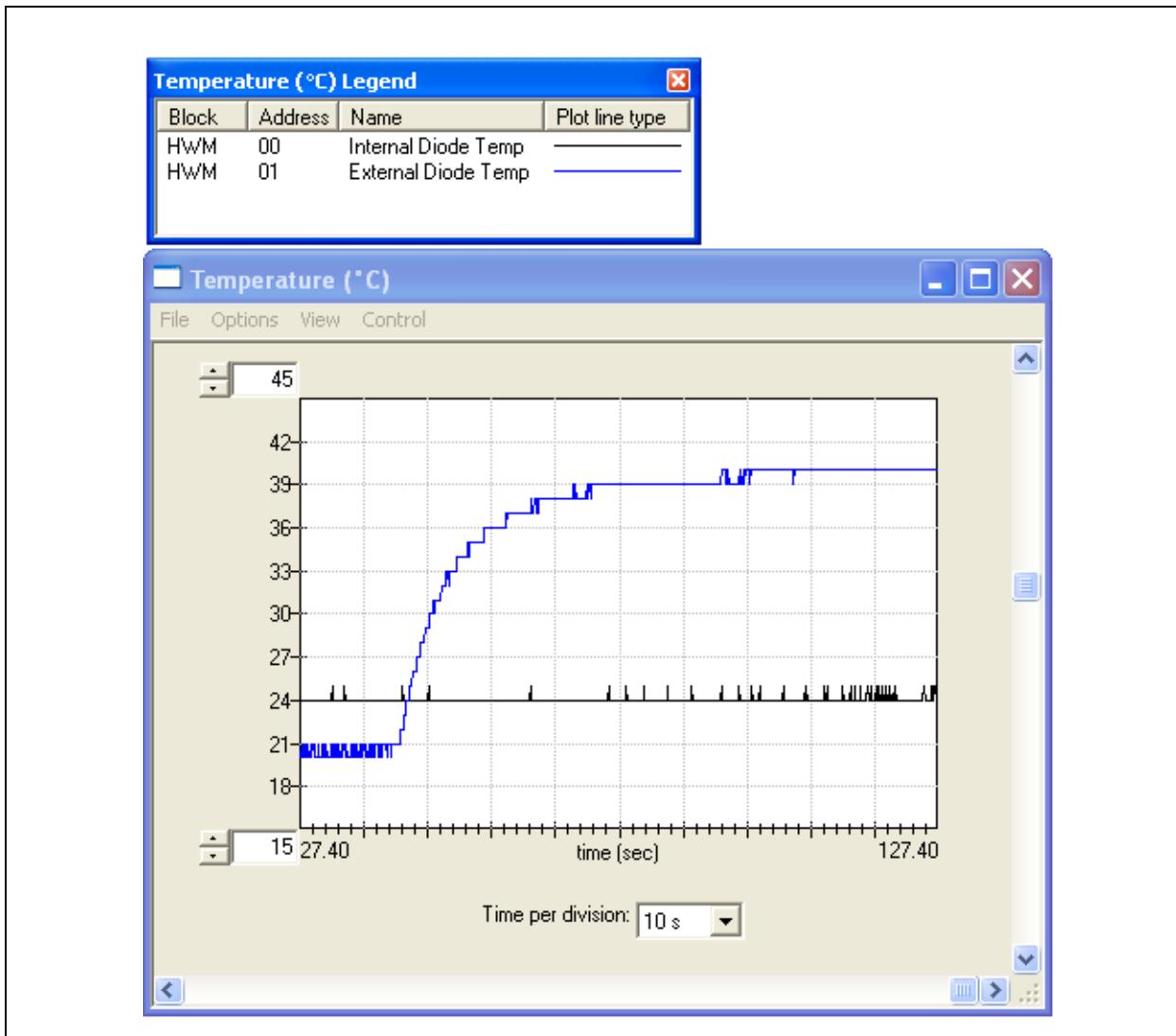


Figure 4.1 EMC2101 Temperature History Graph